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Attorney Docket: *WRIPLASTIC*-Div

OFFICE OF PETITIONS

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of: Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: 08/525,639 New Serial No.: _____

Filed: September 6, 1995 New Filing Date: _____

Group Art Unit: 1106 New Group Art Unit: _____

Examiner: Nina Bhat New Examiner: _____

PETITION TO ACCORD APPLICATION FILING DATE OF EXPRESS MAIL
CERTIFICATE UNDER 37 C.F.R. § 1.10

The Applicant hereby petitions to have the enclosed divisional patent application accorded a filing date of May 15, 1998, the date of deposit as "Express Mail" with the United States Postal Service (as evidenced by the "Express Mail" certificates) as follows:

1. On May 15, 1998 the patent application entitled "Process for Waste Plastic Recycling" by applicant(s) Frank D. Guffey and Floyd Alan Barbour, was deposited with the U.S. Postal Service as "Express Mail" along with the following documents (copies of documents originally filed are included herewith as Exhibit 1):
 - a. a Letter of Transmittal, a fee calculation sheet, a cashier's check in the amount of \$395.00 and a change of correspondence address;
 - b. a Preliminary Amendment;
 - c. copies of parent application, serial number 08/525,639, including copies of the original specification, original claims and informal drawing, the original combined declaration and power of attorney executed by the inventors, a power of attorney executed by the assignee, Western Research Institute, the verified statement establishing small entity status (independent inventor), the verified statement establishing small entity status (non-profit organization), and the assignment of patent rights;
 - d. a new formal drawing (1 sheet);
 - e. an Information Disclosure Citation with copies of the cited references (copies of the references are not attached hereto);
 - f. an Information Disclosure Statement under 37 C.F.R. §1.97 & 1.98;

- g. Express Mail Certificates for each document; and
 - h. a return receipt postcard.
2. As can be seen, the application included Certificates of Mailing by "Express Mail" firmly and securely attached to their respective documents. These certificates include the number of the "Express Mail" mailing label placed thereon prior to mailing, #EM000783532US, and state the date of mailing by "Express Mail". All are signed by the person depositing the application, Ms. Barbara Graves, an employee of the undersigned firm.
 3. A true and correct copy of the actual "Express Mail" mailing label #EM000783532US is also attached as Exhibit 2. As can be seen in the official receipt section (the top section labelled "Origin (Postal Use Only)") it includes the date of mailing, May 15, 1998, and the time of mailing, 16:55. These are the official indications of the date and time at which the mailing was actually received by the US Postal Service.
 4. Although numerous inquiries have been made, as of this date, the applicant has received no response from the PTO indicating that the application has been accorded a filing date by the the Office. Since the Office has now indicated that this application appears misplaced by the Office, the Applicant requests that the enclosed patent application be entered into the file for examination and that it be accorded a filing date of May 15, 1998. As suggested by PTO personnel, it is the undersigned's expectation that because it appears a PTO error has occurred, no petition fee is required. It should be understood, however, that the applicant is willing to submit the prescribed fee should the Office deem it necessary in order to satisfactorily resolve the problem.
 5. Numerous efforts were made over the course of over a year by the undersigned firm in an attempt to determine the status of the above-referenced application. Such actions include:
 - a. As evidenced by Exhibit 3, on September 30, 1998, Barbara Graves, an employee of the undersigned firm determined that the postcard receipt had not yet been received back from the PTO. Ms. Graves directed further efforts to determine the status of the application.
 - b. As evidenced by Exhibit 4, on November 17, 1998, Patti Sortino, an employee of the undersigned firm determined that the cashier's check payable to the PTO had indeed, cleared.
 - c. Shortly after that date, and after several telephone calls to the PTO, a fax was sent to Ms. Kathy Sheffey of the PTO to provide evidence that that check has, indeed, cleared and to request action. This fax is attached as Exhibit 5.
 - d. Since no response was received, another telephone call was made to Ms. Kathy Sheffey of the Patent Office on May 12, 1999, to inquire as to status. This is evidenced by the attached Affidavit of Luke Santangelo (Exhibit 6).
 - e. In response to the renewed inquiry, and as also evidenced by the attached Affidavit of Luke Santangelo, on May 14, 1999 the undersigned spoke with Mr. Preston Wallace of the Patent Office. Mr. Wallace indicated that the application filed on May 15, 1998 may have been mistaken as an amendment by the PTO and that he desired copies of some documents and would begin tracing it within the PTO.

- f. As also evidenced by the attached Affidavit of Luke Santangelo, on May 14, 1999, at the request of Mr. Preston Wallace, the applicant submitted copies via facsimile to Mr. Wallace of items evidencing the filing of the application.
 - g. As also evidenced by the attached Affidavit of Luke Santangelo, on May 17, 1999, Mr. Wallace advised that he had received the facsimile transmission and that he would trace the check and call back.
 - h. On July 12, 1999, another call was made by the undersigned to the Patent Office. This time the undersigned spoke with Ms. Neena Bhat, the examiner in the parent case. From this conversation, it appeared that the PTO had lost almost all of the documents associated with the filing. Ms. Bhat indicated that she would discuss the case with Mr. Preston Wallace and advise if the applicant needed to do anything to proceed.
 - i. As indicated in Exhibit 7, on November 14, 2000, in another telephone call to the Patent Office from the undersigned firm, the Mr. Wallace indicated that the file had not yet been located but that he would continue to look for it.
 - j. As indicated in Exhibit 7, on November 15, 2000, the undersigned firm once again contacted the Patent Office and spoke with Examiner Bhat who indicated that she was not familiar with the case, but that she would look into it further and call back.
 - k. As indicated in Exhibit 7, on November 17, 2000 the undersigned firm spoke with Mr. Doug McGinty of the PTO. Mr. McGinty indicated that the applicant may need to file a petition along with copies of the originally filed application and suggested the firm contact the petitions office.
 - l. As indicated in Exhibit 8, on December 28, 2000, the undersigned spoke with Mr. John Gillon of the Office of Petitions. Mr. Gillon suggested that the present petition be filed to prompt action within the PTO.
6. To firmly establish the mailing procedures and actions in this matter, the affidavit of Barbara Graves is attached. Ms. Graves is an employee of the undersigned firm and is the person who executed all certificates of express mailing in this matter. She coordinated all efforts. As her affidavit establishes, specific firm procedures for Express Mailings to the PTO were in place at the time of the mailing. These procedures are explicitly set forth in Exhibit 9. As can be seen, they unequivocally require the firm's personal to physically deposit the package with United States Post Office. Indeed, as can be seen from the Express Mail receipt in this matter, these procedures were followed and the mailing was made five minutes before closing of the local post office on May 15, 1998.
7. Rule 1.10 provides that any correspondence delivered as Express Mail will be accorded the filing date of the date of deposit as shown by the "date in" official notation on the Express Mail receipt. The rule provides that the correspondence should be deposited directly with the USPS to ensure the receipt of a legible copy of the mailing label as dropping in a box or the like increases the risk of not receiving a legible copy. The rule further provides that in the event the appropriate filing date is not accorded, a petition may be filed after the person becomes aware the office will accord a different filing date. Although the undersigned is not yet aware that the office will accord a different filing date than desired, it now appears appropriate to file a petition to move the matter forward. Further, the rule provides that the

number of the Express Mail label should be on all documents and that a true copy of the Express Mail label should be provided. All of these criteria have been met and thus it appears that the attached papers should be accorded the desired filing date.

8. Naturally, should the office desire additional information, the undersigned stands ready to supply whatever it has available.

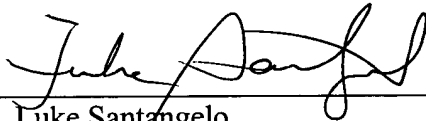
CONCLUSION

The Applicant has submitted with this petition, affidavits of the persons responsible for handling the documents, copies of all documents, and a true and correct copy of the Express Mail label for the filing made on May 15, 1998. Thus, in accordance with the requirements of 37 CFR 1.10, the Applicant respectfully requests that the application be accorded the filing date of May 15, 1998 and processed as a divisional application.

Dated this 5th day of January, 2001.

Respectfully Submitted,

SANTANGELO LAW OFFICES, P.C.

By: 
Luke Santangelo
ATTORNEY FOR APPLICANT
PTO No. 31,997
125 South Howes, Third Floor
Fort Collins, Colorado 80521
(970) 224-3100

accord.pet

Express Mail No: EM 000783532US
Attorney Docket: WRIPLASTIC-Div

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Examiner: Nina Bhat New Examiner: _____

LETTER OF TRANSMITTAL

The Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Dear Commissioner:

Enclosed for filing are the following documents:

- a. a Preliminary Amendment to be entered with this filing prior to calculation of the filing fee;
- b. copies of parent application serial number 08/525,639, including copies of the original specification, original claims and informal drawing, the original combined declaration and power of attorney, the verified statement establishing small entity status (independent inventor), the verified statement establishing small entity status (non-profit organization), and the assignment of patent rights;
- c. a new formal drawing (1) sheet;
- d. Information Disclosure Citation with copies of the cited references;

- e. Information Disclosure Statement under 37 CFR 1.97 & 1.98;
- f. This Letter of Transmittal, a fee calculation sheet and a cashier's check in the amount of \$395.00; and
- g. Express Mail Certificates for each document.

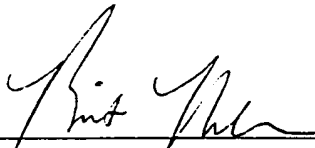
Please confirm receipt of the documents by applying your date stamp and serial number on the enclosed postcard and returning it to me.

Dated: May 15, 1998

Respectfully Submitted,

SANTANGELO LAW OFFICES, P.C.

By: _____


Brit Nelson
ATTORNEY FOR APPLICANT
PTO No. 40,370
125 South Howes, Third Floor
Fort Collins, Colorado 80521
(970) 224-3100

wri\plastic\us\div\div.xmt

FEE CALCULATION SHEET
USPTO Patent Application

(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
TOTAL CLAIMS ¹	16-20 =	0	x \$22.00 =	\$0.00
INDEP. CLAIMS	2-3 =	0	x \$82.00=	0.00
MULTIPLE DEPENDENT CLAIMS (insert Y or N)				
BASIC FEE				790.00
TOTAL OF ABOVE =				790.00
REDUCTION BY 50 % FOR FILING BY SM ENTITY (insert Y or N)			Y	395.00
ASSIGNMENT (insert Y or N)			N	\$ 0.00
TOTAL =				\$ 395.00

¹ TOTAL CLAIMS BASED ON:

16	Numbered claims with:
2	Independent claims (Claims 1, 2)
14	Claims dependent on a single claim (Claims 3-16)
	Claims dependent on a two claims
	Claims dependent on a three claims
	Claims dependent on a four claims
	Claims dependent on a five claims
16	TOTAL CALCULATED CLAIMS

Note: Fees based on October 1, 1997

THIS DOCUMENT HAS AN ARTIFICIAL WATERMARK PRINTED ON THE BACK. THE FRONT OF THE DOCUMENT HAS A MICRO-PRINT SIGNATURE LINE. ABSENCE OF THESE FEATURES WILL INDICATE A COPY.



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University of Wyoming Research Corporation

DATE May 13, 98

REMITTER

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Commissioner of Patents & Trademarks

OFFICIAL CHECK

DRAWER: FIRST INTERSTATE BANK

DRAWER: TRAVELERS EXPRESS COMPANY, INC.
P.O. BOX 3476 MINNEAPOLIS, MN 55480
DRAWEE: FIRST STAR BANK OF MINNESOTA, N.A. ST. PAUL, MN

1:091015224:00500 5520404211

Express Mail No: EM 000783532US
Attorney Docket: WRIPLASTIC-Div

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Examiner: Nina Bhat New Examiner: _____

CERTIFICATE OF EXPRESS MAILING

I, Barbara Graves, hereby certify to the truth of the following items:

1. I am an employee of Santangelo Law Offices, P.C., 125 South Howes, Third Floor, Fort Collins, Colorado 80521.
2. I have this day deposited the attached Letter of Transmittal, Fee Calculation Sheet and cashier's check in the amount of \$395.00 with the United States Postal Service as "Express Mail" for mailing to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DATED: May 15, 1998



Barbara Graves

To: Deputy Commissioner of Patents and Trademarks
Office of Enrollment and Discipline
Attorney Roster
Washington, D.C. 20231

CHANGE OF CORRESPONDENCE ADDRESS

Please accept this as formal notification of a change of correspondence address for:

Santangelo Law Offices, P.C.

Effective: April 1, 1998, the new correspondence address is:

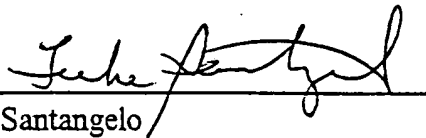
SANTANGELO LAW OFFICES, P.C.
125 South Howes, Third Floor
Fort Collins, CO 80521
(970) 224-3100

Registered attorneys:

Luke Santangelo, PTO No. 31,997
William F. Vobach, PTO No. 39,411
D. Brit Nelson, PTO No. 40,370

Sincerely,

SANTANGELO LAW OFFICES, P.C.

A handwritten signature in cursive script, appearing to read "Luke Santangelo", is written over a horizontal line.

Luke Santangelo
PTO No. 31,997
125 South Howes, Third Floor
Fort Collins, CO 80521
(970) 224-3100

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PRELIMINARY AMENDMENT

Before calculating the fees on the above examination and before examining the above-referenced application, please amend the application as follows:

In the claims:

Please cancel claims 17 - 22.

REMARKS

The claims have been amended to cancel claims 17 - 22 in the original application, leaving claims 1 - 16. In the parent application, the Examiner required a restriction of claims 1 - 16. Therefore, this preliminary amendment narrows the pending claims to those claims required by the restriction.

The enclosed fee sheet is based on the claims remaining after this preliminary amendment.

The Formal Drawings

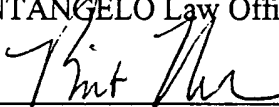
The Applicants file the formal drawing submitted in the parent application as amended in the prosecution of that application.

CONCLUSION

The Applicants submit the method claims from the parent application that were restricted and requests that the Examiner allow the claims at an early opportunity.

Dated this 15 day of May, 1998.

Respectfully submitted,
SANTANGELO Law Offices, P.C.



Brit Nelson
ATTORNEY FOR APPLICANT
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Fort Collins, Colorado 80521
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wri\plastic\us\div\prel.amd

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I, Barbara Graves, hereby certify to the truth of the following items:

1. I am an employee of Santangelo Law Offices, P.C., 125 South Howes, Third Floor, Fort Collins, Colorado 80521.

2. I have this day deposited the attached Preliminary Amendment with the United States Postal Service as "Express Mail" for mailing to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DATED: May 15, 1998



Barbara Graves

PROCESS FOR WASTE PLASTIC RECYCLING

I. TECHNICAL FIELD

5 The present invention relates generally to processes for low temperature thermal decomposition of waste plastics. Specifically, the invention focuses upon achieving decomposition of waste plastics at a lower temperature than was previously possible. In particular municipal, health and industrial waste plastics are processed such as (but not limited to) polyethylene
10 (PE), polypropylene (PP), polystyrene (PS), polyethylene terephthalate (PET), polyurethane (PU), and polyvinyl chloride (PVC).

II. BACKGROUND ART

15 Waste plastics, that is synthetic polymer-containing substances, pose an environmental issue because of the problems associated with disposal: a large volume of non-biodegradable material. Because of the limits on landfill capacity, future recycling or decomposition is a necessity. Direct recycling back to the manufacture is not always feasible because such waste plastic is often mixed with respect to polymer type and separation is uneconomical.
20 Economical considerations for processing waste plastic often require the use of the unseparated mixed waste plastic. Plastic recycling originated with the manufacture of synthetic thermoplastics. Rejected parts, trim, and flash from operations represented valuable materials that were ground and recycled with virgin material. This process was potentially repeated a number of times
25 provided the percentage of regrinds remained low. As long as the plastic scrap generated by the industry was clean and uncontaminated with other plastics, reprocessing within the industry continued to expand, provided the price of virgin plastic remained high. After 1960 with a decrease in prices, profit margins for plastic scrap were squeezed, and disposal instead of reprocessing
30 often occurred.

35 After 1970, plastic prices rose again due to OPEC raising the cost of petroleum feedstocks and recycling practices again increased. Interest increased not only in processes for reclaiming waste plastics, such as product evaluation for chemicals and fuels, but also in the necessary step of separation

of plastics from other waste material. A review of this early history of plastics recycling is given by R.J. Ehrig in *Plastics Recycling*, Oxford University Press, NY, 1992, hereinafter referred to as Ehrig (1992). Some of the early operating plants for recycled plastic included a Department of Energy funded plant in LaPorte, Texas, which used a fluidized bed of sand and was designed for 17 million pounds per year of atactic polypropylene. It ran from 1980-82. In 1984 at Ebenhausen, Germany, a 20 million pound per year plant used molten salt with a fluidized bed reactor to process plastic wastes and tires.

In all cases economics governed whether such plants continued operation. Since 1985 plastics recycling has become more economically feasible due to continued plastics technological growth and increased environmental concern, however, significant cost impacts remain due to the level of the elevated temperatures previously required.

III. DISCLOSURE OF INVENTION

The present invention relates to a process which overcomes the above-mentioned deficiencies in the prior art and to a process which achieves decomposition of waste plastic at a relatively low temperature. As one example, the process decomposes a mixed stream of waste plastic at a temperature generally less than 375°C in a hot oil medium. The process converts the polymeric structure of the waste plastic or plastics to smaller chemical molecules such as the monomeric units and related chemical structures at a relatively lower temperature. It also serves the market for the such products. Since this market is not a to-be-developed manufacturing process, but rather one for which existing plants in the refining and petrochemical industries already exist, the process is adaptable to existing facilities that are already experiencing limited supplies of low molecular-weight, heteroatomic free feedstocks from petroleum crude oils. The low-molecular weight distillate from waste plastic processing according to this invention may help reduce the demand for imported petroleum products and help decrease our dependence on foreign crude oil.

Basically the process is one in which the materials to be reacted are added or controlled so as to assure the existence of sufficient or appropriate amounts of free radicals. These free radicals are included to initiate free radical chain depolymerization reactions known to "unzip" polymer structures. To avoid recombination and to further enhance the process, this reaction is accomplished in a diluent such as an oil.

IV. BRIEF DESCRIPTION OF THE DRAWING

Figure 1 shows a schematic diagram of a system for processing recycled waste plastic according to one technique of the present invention.

V. BEST MODE FOR CARRYING OUT THE INVENTION

The subject invention processes or decomposes mixed waste plastic at a relatively very low temperature. It may use thermal degradation in an oil media. Typical thermal degradation of waste plastics, such as that associated with municipalities waste, has previously required 400-600°C. Through the present invention, this may occur at below about 375 °C. This represents a saving of energy requirements and capital costs. In basic form, the invention is a process for the low-temperature thermal decomposition of waste plastics by a free radical mechanism at temperatures below 375°C. This may be accomplished in a diluent such as oil. This diluent does not significantly impact the action of the free radicals, serves to maintain energy levels, reduce chemical interaction, and serves as a diluent so as to avoid recombination of reactive products. As those skilled in the art could readily ascertain, the free radicals are neutral, unpaired electron shell substances which initiate the process and may be provided by a free radical precursor. These precursor substances are essentially all substances capable of providing free radicals at the condition chosen for the reactant. As those skilled in the art would also readily understand, they may include certain plastic resins (ie. polyvinyl chloride, polyurethane, and most likely nylon 66) and almost any other materials which produce the free radicals, such as those materials containing carbon-carbon, carbon-nitrogen, carbon-oxygen, or carbon-sulphur bonds as well some other compounds which may be free radical initiators and which do

not volatilize too quickly in the reacting conditions chosen. The free radical precursors may exist as part of the waste plastic, may be a separately added substance, or may even be added to the diluent. The low-temperature activity of the present invention is believed to be attributed to the free radical chain depolymerization reactions known to "unzip" synthetic polymer structures. The free radical(s) liberated from polyvinyl chloride or from other sources at temperatures below 375°C act as initiators to start the process. In an oil, free radicals from the initiator attack the polymer structure to satisfy their electronic structures. This results in the abstraction of a proton from the polymer molecule which initiates the free radical process in the polymer chain to break the structure into smaller molecules. The result is decomposition of the plastic at temperatures lower than previously expected. The resultant products are likely to be a distillate, coke, noncondensable hydrogen, and other gases.

In establishing the preferred embodiment of the invention, it is believed that there are three important conditions for low-temperature thermal decomposition of such plastics to occur. First, the plastic may need to be diluted in a diluent such as an oil solution to prevent recombination reactions. Second, if the free radical initiators are generated from the waste plastic, the plastics composition must contain resin types, such as polyvinyl chloride, that decompose at temperatures below 375°C to generate free radicals. Third, even though the initiator concentration must be low, in a continuous process, it appears necessary to maintain the level at a critical concentration of about 0.5% (wt) to maintain the reaction.

As mentioned, the oil is believed to serve a variety of functions. In addition to those previously mentioned, it may act as a diluent which limits termination reactions that produce the higher molecular weight species as discussed above. It may also serve as a heat transfer media to ensure uniform heating of the waste plastics. The nature of the oil utilized in the process does not appear to be critical to many waste plastic degradation applications, but it may change the technical processing requirements. One choice is used motor

oil since it, itself is waste material. Yet other oils include but are not limited to heavy oils (that is, oils not distillable at the conditions chosen for the reactant or about 1 atmosphere pressure at up to 400 °C), fluidized bed catalytic cracker slurry oil, distillation tower vacuum bottoms, and heavy heating or bunker oil.

The stability of the oil at process conditions may impact the ability to recycle the oil as well as the amount of overhead distillate formed. Low value oils, that is oils either high in elements other than carbon and hydrogen oils of high molecular weight, particularly aromatic substances, or substances having a low hydrogen to carbon atomic ratio may also be used. This can afford a significant economic advantage as such substances are likely to be undesirable for other purposes and may be readily available at refinery sites. In addition, utilization of low value oils in the process of the present invention can create a result which basically can be characterized as combining two undesirable or waste materials to create a desirable and useful material.

As mentioned a distillate may be formed. This may include a general hydrocarbon material whose volatility allows it to become overhead vapor material under certain conditions. For the preferred embodiment, this occurs at approximately 375 °C under nominal pressure of about one atmosphere. Importantly, the products of the process may be materials which either have economic value and can be utilized in the market place, can be consumed by the process, or can be safely released to the environment.

For most situations the common range of normal volatility for distillate formed from mixed waste plastics according to this process is about 40-375 °C. Higher boiling hydrocarbon materials remain with the heavy oil. The distillate products may contain components that could be classified as value-added products (ie. toluene and styrene). These are not usually produced by the present process as pure compounds in the distillate. Instead they are likely to be present in complex mixtures with other hydrocarbon species in the preferred embodiment. Naturally, separation may be achieved

to obtain these components in pure form. This may occur site if the economics warrant. Alternatively, the distillate or products may be marketed without additional separation. The whole distillate may have market value as a feedstock to the petrochemical and refining industries. The use of these distillates or products in the refining industry is attractive because the types of compounds present indicate they might be useful as octane additives for the production of unleaded gasoline. The aromatic compounds (toluene, ethylbenzene, etc.), and the branched and cyclic structures are known to have relatively high octane numbers which can be used to enhance the octane rating of gasoline.

Five waste plastics may be considered as often included in a typical waste plastic stream. These are polyethylene (PE), polypropylene (PP), polystyrene (PS), polyethylene terephthalate (PET), and polyvinyl chloride (PVC). Thayer reported a distribution for municipal wastes of PE: 63%, PS: 11%, PP: 10%, PET: 7%, PVC: 5%, Other: 4%; See Solid Waste Concerns Spur Plastic Recycling Efforts, Chemical & Engineering News, p7, January 30, 1989; hereinafter Thayer (1989). By ignoring the remaining 4%, this information produced the basis for one common mixed waste plastic experimental composition.

Figure 1 shows a typical process system in schematic form. The raw mixed waste plastic is supplied by a first supply means 10 and is fed to a mechanical chopper 11 which produces a chopped up, or comminuted, plastic material 12. This chopped mixed waste plastic 12 enters a lock hopper 20 or some mix means which may mix it with a diluent supplied by a second supply means 25. It may also store the mix and meter it 21 into a solution tank 22 that is well stirred or mixed 23 (potentially continuously) and has an appropriate amount of diluent such as oil from second supply means 25 or from recycling mixed with it at about 200 °C. The lock hopper 20 may include some type of star valve to prevent the escape of vapor. Further, the solution tank 20 may be utilized to assure that the plastic is solubilized in the heavy oil that is recycled to this tank from farther through the process. The oil flux through this tank may thus be maintained to allow sufficient residence

time in the tank to stabilize the plastic.

The oil may be cycled through from further down the process and may additionally contain a selected amount of new oil 47. The ratio of oil to plastic may not be critical but a range of from about 2:1 to 10:1 oil to plastic appears to work. This solution of oil and plastic 24, may be stirred 23 at all times. The system may have an injected free radical precursor 32 which may enter the reaction container 41 at some control means 40. This may include some type of controllable valve and may also include some type of controlling logic 33. This may act to control the content of the solution to assure that it will contain a sufficient free radical content when heated so that substantially all waste plastic is decomposed. The free radical precursor 32 may be injected when needed by monitoring and sensing the conditions within the reaction container 41. If the overhead 43 decreases sufficiently (most likely sensed by an increase in the reactant temperature ascertained or a decrease in the amount of heat needed to maintain a given reactant temperature), it likely indicates that the relative amount of free radical precursor has dropped so more free radical precursor 32 may be automatically added. (Naturally, only the relative proportions are involved so one could conversely hold the amount of free radical precursor 32 steady and adjust the amount of waste plastic.)

Preferably the free radical precursor 32 is chosen to decompose at or below the nominal reactor temperature into some free radical or free radicals. Thus, acceptable free radical precursors include polyvinyl chloride, polyurethane, and other materials that will thermally form free radicals at temperatures at or below the reaction temperature selected. These free radical precursors may be stored in some third supply means 31 until use and may even be waste plastic themselves.

The reaction container 41 may be well stirred 42 and may have entering the solution of oil, plastic, and precursor material, cycled back heavy oil 44, and some new heated oil 45. Again, the residence time in the reactor or reaction container may be maintained to maximize plastics conversion.

Further, product 46 may be recycled through the head space of the reactor to aid in removing volatiles from the reaction zone.

As shown, the reactor heavy oil 46 leaves and passes through a multipurpose heat exchanger or temperature control means 48 (such as a heater) where it is heated or cooled depending upon conditions of operation and leaves 49 to be pumped 50, cycled back 44, exited 51, or fed to the solution tank 22. This residual heavy oil may suffer some thermal degradation and may contain a portion of the plastic degradation that is not thermally decomposed. Thus, some heavy oil may be discharged 51 and fresh oil 47 inserted. In many instances the amount of oil or heavy oil recycled 44 may be in the range of approximately 70-90 percent, preferably about 80-85 percent, of the reactor fluid. Yet the process will usually work with a heavy oil recycle amount from zero to about 95 percent. Zero, or no, heavy oil recycled means a straight through flow process.

The multipurpose heat exchanger 48 may act as a regenerative heater for the fresh oil 47, which may be preheated by the recycled heavy oil entering 46 and leaving 49, before entering 45 the reaction container 41. It also may serve to heat the reactor heavy oil as heavy oil recycle 44 to keep the reaction temperature adequate. This normally has a range of about 300-375 °C. This heating operation can involve a heat source such as steam, burned fuel, fuel from the overhead gas 60, or coke and other solids formed from plastic decomposition and subsequently recovered material.

The reactor overhead 43 potentially consists of three components: a noncondensable overhead gas 60, a condensable liquid stream of overhead distillate 64 that is collected and stored 65, and condensable overhead specialty decomposition substances 66. Thus the condenser 61 or some collection means can be two-staged. The first stage may condense, perhaps in a modified cyclone arrangement, any such overhead specialty decomposition substances. These are usually solid 66, and largely come from PET degradation. The second stage may operate with cooled water 62 which then

leaves 63 and condenses the overhead distillate 64, the major process product. Thus the amount of PET in the mixed waste plastic may govern how much solid is potentially present and collected. Also a small amount may be handled by becoming entrapped in the heavy oil 51. The overhead gas 60 may pass through the condenser 61 unaffected; however, before further use it can be water scrubbed to remove HCl or other halide acids.

Various equivalent flow sheets are possible and that shown in Figure 1 is only one of many potential that could carry out the subject invention.

EXPERIMENT 1

Before mixed plastic wastes were studied, each individual component plastic was thermally decomposed to have a basis for the difference between mixed and individual resource recovery, and whether the mixed plastic wastes when thermally decomposed had an unexpected interaction.

The thermal decomposition was performed in hot fresh oil, usually at temperatures between 375 and 450°C, as a convenient substance that dissolved the plastics. Further, used or waste motor oil was a convenient fresh oil source and in itself represented a waste product. Other fresh oils that were mostly stable below 450 °C were employed such as fluidized bed catalytic cracker Slurry oil, distillation tower vacuum bottoms, and heavy heating or bunker oil. For convenience, most studies employed a simulated used or waste motor oil which was SAE 50 motor oil.

A laboratory setup was used for preliminary experimentation which consisted of a thermally regulated flask with water condenser. The flask temperature was regulated to within 5 °C and the overhead distillate condensed with 16 °C water while the amount of uncondensed overhead gas was measured. The SAE 50 oil and the appropriate plastic resin were placed into the flask and the flask was purged with nitrogen before heating began. After the proper time at temperature, the flask was quenched.

The range temperatures was 375 to 450 °C for most plastics; however, PVC and PET were too reactive at these temperatures and their range was reduced to 285 to 360 °C. The reaction time varied up to one hour in 15 minute increments.

The important individual results which varied with the type of plastic were as follows:

PE: With 75 % oil and 25 % PE starting and a 45 minute operating time, little overhead distillate was condensed below 425 °C but here 9.0% of the total product mix was overhead distillate. At 450 °C 28.6% was distillate indicating some of the original oil had been decomposed. Heavy oil containing some decomposition products remained in the flask. For all temperatures no measurable coke was produced and the overhead gas was less than 2.5%. For the time varying experimentation at 425 °C, the overhead distillate increased with time peaking at 11.3% at one hour. A gas chromatography/mass spectrometry detailed study of the 425 °C overhead distillate indicated over 64 organic compounds and the 15% majority was classified as a mixture of C₄ substituted cyclopentanes.

PP: With 75 % oil and 25 % PP starting and a 45 minute operating time, little overhead distillate was condensed below 400 °C but here 9.5% of the total product mix was distillate. At 425 °C 14.9% was distillate with apparently minuscule oil decomposed. Heavy oil containing some decomposition products remained in the flask. For all temperatures investigated no measurable coke was produced, and the overhead gas was less than 2.0%. For the time varying experimentation at 425 °C, the overhead distillate increased with time peaking at 18.6% at one hour. A gas chromatography/mass spectrometry detailed study of the 425 °C overhead distillate indicated over 55 identified organic compounds and the 5.9% majority was identified as 1,4 pentadiene with a close second at 5.3% classified as C₄ substituted octane.

PS: With 75 % oil and 25 % PS starting and a 45 minute operating time, little overhead distillate was condensed below 390 °C but here 7.0% of the total product mix was overhead distillate. At 425 °C 33.7% was overhead

distillate indicating some of the oil had been decomposed. Heavy oil containing some decomposition products remained in the flask. For all temperatures no measurable coke was produced and the overhead gas was less than 1.5%. For the time varying experimentation at 400 °C, the overhead distillate increased with time peaking at 18.9% at one hour. A gas chromatography/mass spectrometry detailed study of the 400 °C overhead distillate indicated over 49 identified organic compounds and the large 33.2% majority was identified as styrene.

PVC: With 89% oil and 11% PVC starting and a 45 minute operating time, little overhead distillate was condensed even at 360 °C, the maximum temperature employed, but here only 1.2% of the total product mix was overhead distillate. Heavy oil containing some decomposition products remained in the flask. For all temperatures coke production increased with temperature and was 7.8% at maximum temperature. Except for HCl, overhead gas production was always minimal. HCl production was constant at 6.1% with no temperature variation and apparently most chlorine appeared in this form.

PET: With 86% oil and 14% PET starting and a 45 minute operating time, no overhead distillate was condensed. At 375 °C, the maximum temperature employed, a Solid product of 7% of the total product mix was obtained, and this was likely terephthalic acid and/or benzoic acid. This solid product sublimed and collected largely in the flask neck making the material balance less accurate. Heavy oil containing some decomposition products remained in the flask. For all temperatures coke production decreased with temperature and was 15% at 325 °C but only 6% at 375 °C. Overhead gas production was always minimal.

EXPERIMENT 2

A review of the tests in Experiment 1 indicated that the apparent optimum temperature for hot oil decomposition of PE and PP was about 425 °C, about 400 °C for PS, about 375 °C for PET, and about 325 °C for PVC. Thus a temperature staging process was employed with mixed waste plastic, often called mixed resins. However PET was not employed in this experiment

since its solid decomposition product tended to clog the apparatus. A further aspect in omitting PET was that recent trends in recycling of waste plastic have been to separate out the bottles made of PET and recycle them directly to the bottle manufacturer.

A three stage temperature experiment was performed using 270 °C for 20 minutes, 410 °C for 30 minutes, and 450 °C for 45 minutes. The oil to mixed resins ratio was ten to one. The selected reactant mixed resins were proportioned to the amounts reported by Thayer (1989). Three different combinations of oil and sweep gas were employed, SAE 50 oil with and without nitrogen sweep gas, and fluidized bed catalytic cracker slurry oil with nitrogen sweep gas. The results are presented in Table 1 where the products section for distillate was the incremental distillate produced at that temperature. The total distillate was the sum of all distillate produced during the experiment. By summing over each experiment temperature, the cumulative distillate production was obtained. The heavy oil product represented the remaining input oil plus what product compounds remained dissolved in it.

Referring to Table 1, at all temperatures much of the SAE 50 oil was decomposed, and this large amount was unexpected from the results found from the individual components in Experiment 1. Evidently a free radical which promoted decomposition was occurring for even at the lowest temperature, 270 °C, the results of Experiment 1 indicated only PVC would decompose. Thus, the free radicals produced from PVC appeared to initiate the decomposition reaction of PE, PP, and PS, and as well as for the SAE 50 oil.

For the slurry oil experiment the free radical only affected the mixed resins as the slurry oil apparently did not decompose even at 450 °C. Further the mixed resins essentially decomposed completely at the lowest temperature of 270 °C. A further favorable aspect was that no measurable coke was formed with this slurry oil.

Table 1.
Material Balances for the Experiments Investigating
Temperature-Staged Thermal Decomposition of Mixed Plastics

Sweep Gas	None	Nitrogen	Nitrogen
Oil	SAE 50	SAE 50	Slurry Oil
Stage I, °C	270	270	270
Stage II, °C	410	410	410
Stage III, °C	450	450	450
Reactants			
Oil, g	100.00	100.00	87.45
PVC, g	0.60	0.60	0.44
Polystyrene, g	1.20	1.20	0.97
Polypropylene, g	1.10	1.10	0.88
Polyethylene, g	7.10	7.10	5.55
Total, g	110.00	110.00	95.29
Products			
Heavy Oil, g	27.08	18.82	89.25
Total Distillate, g	74.90	81.04	5.62
at 270°C	17.06	12.44	5.61
at 410°C	14.95	33.77	0.01
at 450°C	42.89	34.83	0.00
Hydrochloric acid, g	0.32	0.32	0.23
Coke, g	2.88	2.12	0.00
Gas, g	3.44	7.70*	0.11*
Total, g	108.62	110.00	95.21
Closure, %	98.7	100.00	99.9

* Gas production determined by difference

EXPERIMENT 3

It appears from the previous experiments that sufficient free radicals were needed to enhance the rate of decomposition at the low temperatures. Thus, if the fraction of PVC was insufficient in the mixed waste plastic to generate enough free radicals, some source of additional free radical was added. The control mechanism for the process was based upon this action. Since the decomposition reactions were highly endothermic, if insufficient free radicals were present when adequate mixed resins were dissolved, the temperature of the system rose beyond the normal targeted 375 °C, and further the amount of distillate formed decreased significantly. To compensate, an additional source of free radicals was added to bring down the temperature and increase the distillate production. Extra free radical precursor up to about 10% of the waste plastic mix did not adversely affect the process.

This suggested that operating under about 375 °C was feasible to decompose the mixed resin and that the time factor was not critical. The fresh oil source is believed not crucial in many applications and apparently any available high-boiling oil that was processable by refinery operations was potentially usable.

The process can employ a wide range of input waste plastics ranging from pure PE, PP, PS, PET, and PVC, along with adequate free radical precursor added. Likewise any convenient mixture of such mixed plastics was usable as input to the process. Thayer (1989) reported that four percent of municipal waste plastic fell into an other category and was not separately identified. Yet this other category appeared processable by the subject invention since even if it did not decompose, it remained in the residual heavy oil. Further if it formed solids, recovery was with the coke and likely burned. Thus a separate group of mixed waste plastic is defined as 'other waste plastic' and consists of all other plastic types besides PE, PP, PS, PET, and PVC.

The products from this process have potential depending upon economics. These are in general overhead gas, overhead distillate, overhead specialty decomposition substances, residual heavy oil, and halide acids. The overhead distillate may potentially feed refinery stocks. Overhead gas may be burned for energy to heat the oil, or if not needed, may be flared. The halide acids, preferably hydrogen chloride, may be recovered as largely hydrochloric acid. The overhead specialty decomposition substances may be largely decompositions from PET, such as terephthalic acid and benzoic acid and may have good commercial potential if purified. The residual heavy oil and any coke may be burned. Products that are cycled back and burned to provide heat for the process are referred to as burnable products.

The foregoing discussion and the claims which follow describe a preferred embodiment of the present invention. Particularly, with respect to the claims, it should be understood that changes may be made without departing from the essence of the invention. In this regard it is intended that such changes would fall within the scope of the present invention. It simply is not practical to describe and claim all possible revisions to the present invention which may be accomplished. For instance, the claims are directed to both methods and apparatus. Although each have been included in various detail, they represent only initial claims directed toward only some basic aspects of the invention. The various permutations and combinations of the claims presented and of other aspects disclosed in the specification are intended to be encompassed within the claims and should be understood to be supported by the existing disclosure. Naturally, the disclosure of processes or methods should be construed to address apparatus utilized to achieve such processes or methods and should be construed to support a full scope of method and apparatus claims. While these may be added to explicitly include such details, the existing claims should be construed to encompass such aspects. In addition, the present disclosure should be construed to encompass subclaims similar to those presented in a process, method and apparatus context.

In addition, the extent any revisions utilize the essence of the invention, each would naturally fall within the breadth of protection encompassed by this patent. This is particularly true for the present invention since its basic concepts and understandings are fundamental in nature and can be broadly applied. The foregoing description of the specific embodiments so fully reveal the general nature of the invention that others can, by applying current knowledge, readily modify or adapt for various applications to suit specific applications. Such embodiments will not depart from the generic concept, and therefore should be deemed to fall within the meaning and range of equivalents of the disclosed and claimed embodiments. It should also be understood that the phraseology and terminology herein is for the purpose of description and not of limitation.

VI. CLAIMS

We claim:

1. A process for decomposing waste plastic comprising the steps of:
 - a. supplying waste plastic;
 - b. mixing said waste plastic with a diluent to create a solution;
 - c. controlling the content of said solution to assure that it will contain a sufficient free radical content when heated; then
 - d. heating said solution to a reactant temperature to substantially depolymerize the waste plastic; and
 - e. collecting the by products of said depolymerization process.
2. A process for the recycling of waste plastic comprising:
mixing said waste plastic, selected from comminuted waste plastic comprising polyethylene, polypropylene, polystyrene, polyethylene terephthalate, polyvinyl chloride, other waste plastic, and combinations thereof, with oil, selected from waste motor oil, fluidized catalytic cracker slurry oil, distillation tower vacuum bottoms, and heavy heating or bunker oil, and combinations thereof, and free radical catalyst precursor; heating to between 325 and 375°C for less than about one hour; and meeting process energy requirements by recycling back burnable products.
3. A process for decomposing waste plastic as described in claim 1 wherein said step of heating said solution to a reactant temperature to substantially depolymerize the waste plastic comprises the step of heating to less than about 400 °C.
4. A process for decomposing waste plastic as described in claim 1 wherein said step of heating said solution to a reactant temperature to substantially depolymerize the waste plastic comprises the step of heating to about 375 °C.
5. A process for decomposing waste plastic as described in claim 1

wherein said step of controlling the content of said solution to assure that it will contain a sufficient free radical content when heated comprises the step of adding an additional substance to said process.

- 5 6. A process for decomposing waste plastic as described in claim 1 wherein said step of controlling the content of said solution to assure that it will contain a sufficient free radical content when heated comprises the step of assuring an appropriate amount of free radical precursor is present in said process.
- 10 7. A process for decomposing waste plastic as described in claim 6 wherein said step of assuring an appropriate amount of free radical precursor is present in said process comprises the step of adding a particular waste plastic material to said process.
- 15 8. A process for decomposing waste plastic as described in claim 6 wherein said step of assuring an appropriate amount of free radical precursor is present in said process comprises the step of adding a substance chosen from a group consisting of polyvinyl chloride and
- 20 polyurethane.
- 25 9. A process for decomposing waste plastic as described in claim 1 wherein said step of controlling the content of said solution to assure that it will contain a sufficient free radical content when heated comprises the step of sensing the relative amount of free radicals likely to be present in said solution after it is heated.
- 30 10. A process for decomposing waste plastic as described in claim 9 wherein said step of sensing the relative amount of free radicals likely to be present in said solution after it is heated comprises the step of ascertaining the reactant temperature of the solution.
11. A process for decomposing waste plastic as described in claim 1 and

further comprising the step of recycling a portion of said diluent.

12. A process for decomposing waste plastic as described in claim 1 and further comprising the step of recycling from 0 to 95% of said diluent.

13. A process for decomposing waste plastic as described in claim 11 wherein said step of recycling a proportion of said diluent comprises the step of recycling from 70% to 90% of said diluent.

14. A process for decomposing waste plastic as described in claim 1 wherein said step of mixing said waste plastic with a diluent to create a solution comprises the step of mixing said waste plastic with an oil.

15. A process for decomposing waste plastic as described in claim 1 wherein said step of mixing said waste plastic with a diluent to create a solution comprises the step of mixing said waste plastic with a heavy oil.

16. A process for decomposing waste plastic as described in claim 1 wherein said step of mixing said waste plastic with a diluent to create a solution comprises the step of mixing said waste plastic with a low value oil.

17. A system for decomposing waste plastic comprising:

- a. a first, second, and third supply means;
- b. a mix means responsive to at least two of said supply means;
- c. a reaction container connected to said mix means and responsive to said third supply means;
- d. a temperature control means connected to said reaction container;
- e. a collection means connected to said reaction container; and
- f. a control means wherein said third supply means is responsive to said control means.

18. A system for decomposing waste plastic as described in claim 17 wherein said first supply means supplies waste plastic and wherein said second supply means supplies a diluent.
- 5 19. A system for decomposing waste plastic as described in claim 18 wherein said second supply means supplies an oil.
- 10 20. A system for decomposing waste plastic as described in claim 19 wherein said second supply means supplies an oil selected from waste motor oil, fluidized catalytic cracker slurry oil, distillation tower vacuum bottoms, heavy heating or bunker oil, or combinations thereof.
- 15 21. A system for decomposing waste plastic as described in claim 17 wherein said temperature control means achieves temperatures of no more than 400 °C.
- 20 22. A system for decomposing waste plastic as described in claim 20 wherein said control means is responsive to the temperature within said reaction container.

VII. ABSTRACT

5 A process for recycling or decomposing waste plastic where such waste plastic is decomposed in a diluent such as hot oil through actions involving free radical precursor, such as polyvinyl chloride or polyurethane, is achieved at low temperature. The thermal decomposition (or pyrolysis) reaction is for about 1 hour at 375°C, and useable products, such as distillate, coke, and oil are recovered. Additionally the diluent may be recycled within the process.

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE
PCT BRANCH

In Re the Patent Application of:

Frank D. Guffey and Floyd A. Barbour

International Filing Number: _____

Priority Date: _____

For:

Process for Waste Plastic Recycling

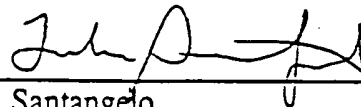
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Luke Santangelo

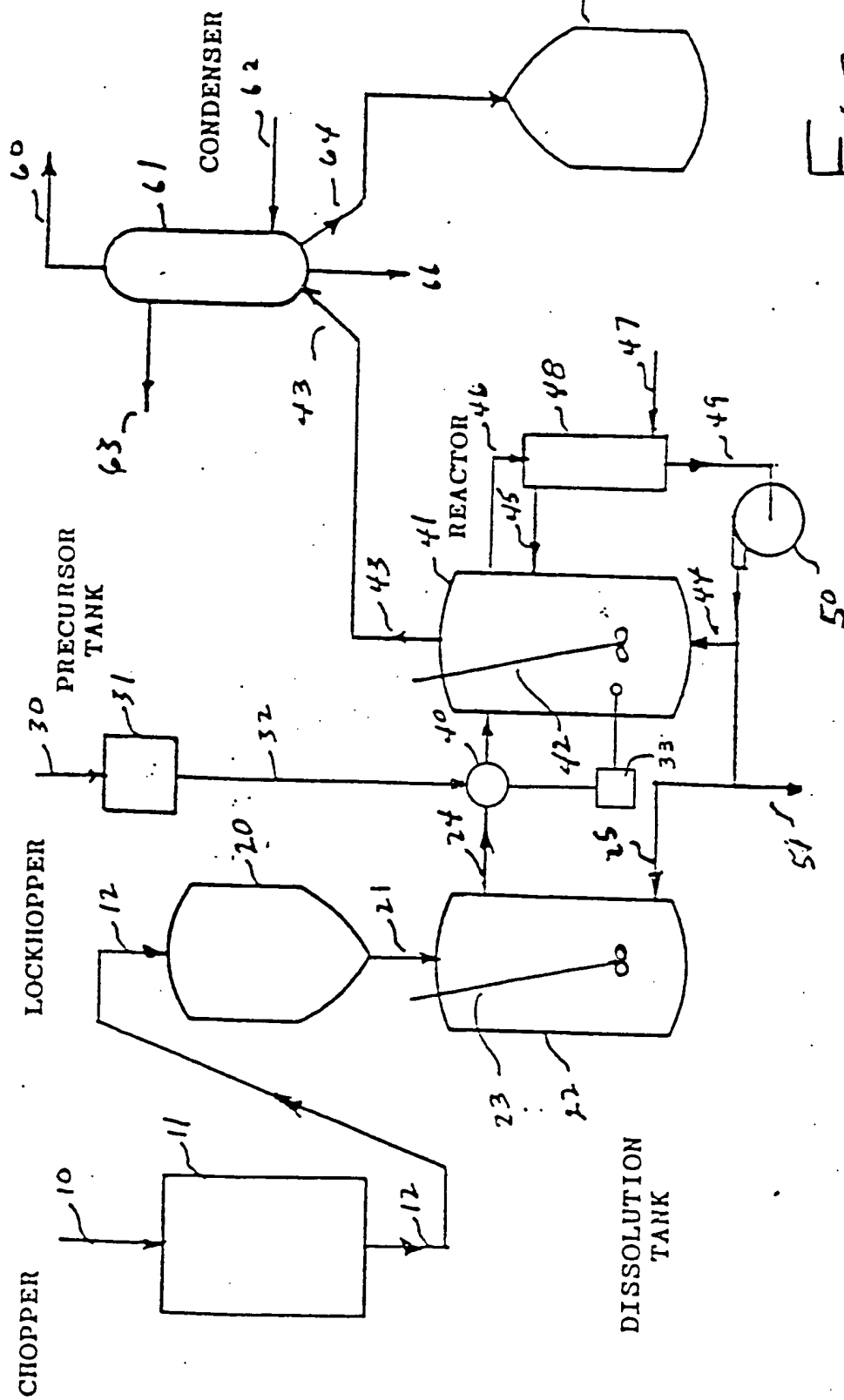


Fig. 1

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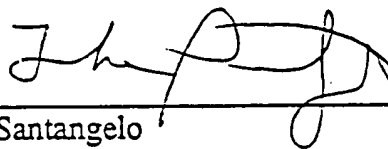
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Luke Santangelo

I hereby claim the benefit under 35, United States Code, §120 of any () states application(s) or PCT international application(s) designating the United States of America that is/ listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that, those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112. I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
08/028,844	10 March 1993			X

PCT APPLICATIONS DESIGNATING THE U.S.

PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)		
PCT/US94/002432	08 March 1994			

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

Send Correspondence to:

Direct Telephone Calls to:
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201	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
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203	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201

SIGNATURE OF INVENTOR 202

SIGNATURE OF INVENTOR 203

DATE

DATE

DATE

Attorney Docket: *WRIPLASTIC*
Express Mail: *TB138968049US*

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of:

Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: (US original) 08/028,844 (new) _____
(PCT) PCT/US94/002433

Filed: (US original) March 10, 1993 (new) _____
(PCT) 08 March 1994

Group Art Unit: (US original) 1204 (new) _____

Examiner: (US original) D.C. Jones (new) _____

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I, Barbara A. Graves, hereby certify to the truth of the following items:

1. I am an employee of Santangelo Law Offices, P.C., 315 West Oak Street, Suite 701, Fort Collins, Colorado 80521.
2. I have this day deposited the attached Form 1391 Combined Declaration for Patent Application and Power of Attorney with the United States Postal Service as "Express Mail" for mailing to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DATED: September 6, 1995

Barbara A. Graves

Attorney Docket No: WRIPLASTIC

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Application of: Frank D. Guffey and Floyd Alan Barbour

For: Process for Plastic Recycling

Serial Number: _____

Filed: _____

Assignee: *The University of sm 8/21/95*
A Wyoming Research Corporation d/b/a Western Research Institute

POWER OF ATTORNEY

The University of sm 8/21/95

A Wyoming Research Corporation d/b/a Western Research Institute, hereby appoints Santangelo Law Offices, P.C., whose mailing address is 315 West Oak Street, Suite 701, Fort Collins, Colorado 80521, including Luke Santangelo, whose registration number before the United States Patent and Trademark Office is 31,997, and William F. Vobach whose registration number before the United States Patent and Trademark Office is 39,411 as its attorney/agent to prosecute this application entitled "Process for Plastic Recycling" and to transact all business in the Patent Office connected therewith.

Date: 8/21/95

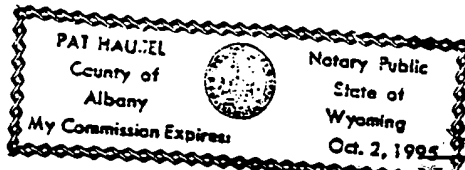
The University of sm 8/21/95
A Wyoming Research Corporation

by: Samuel M. Dorrence
Samuel M. Dorrence, Vice President and Assistant Secretary *sm 8/21*

UNITED STATES OF AMERICA)
)
STATE OF WYOMING)ss.
)
COUNTY OF Albany)

SUBSCRIBED AND SWORN to before me in the County of Albany, State of Wyoming, United States of America, by Samuel M. Dorrence, as Vice President, of Wyoming Research Corporation, this 21st day of August, 1995. *and Assistant smd 8/24/95 secretary*

WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Wyoming.



Pat Hauzel
Notary Public
My Commission Expires: October 2, 1995

Attorney Docket: WRIPLASTIC
Express Mail: TB138968049US

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of:

Frank D. Guffey and Floyd Alan Barbour

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(PCT) 08 March 1994

Group Art Unit: (US original) 1204 (new) _____

Examiner: (US original) D.C. Jones (new) _____

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I, Barbara A. Graves, hereby certify to the truth of the following items:

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2. I have this day deposited the attached Power of Attorney from the University of Wyoming Research Corporation with the United States Postal Service as "Express Mail" for mailing to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DATED: September 6, 1995

Barbara A. Graves

Filed or Issued:

For:

Process for Waste Plastic Recycling

— Express Mail No: TB138968049U—

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
STATUS (37 CFR 1.9 (f) and 1.27 (b)) — INDEPENDENT INVENTOR**

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9 (c) for purposes of paying reduced fees under section 41 (a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled Process for Waste Plastic Recycling described in

☒ the specification filed herewith

☐ application serial no. _____, filed _____

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FULL NAME d/b/a Western Research Institute
ADDRESS 365 North 9th Street, Laramie, Wyoming 82071-3395

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☐ SMALL BUSINESS CONCERN

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☐ SMALL BUSINESS CONCERN

☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28 (b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Frank D. Guffey
NAME OF INVENTOR

Floyd Alan Barbour
NAME OF INVENTOR

NAME OF INVENTOR

Frank D. Guffey
Signature of Inventor

Alan
Floyd A. Barbour
Signature of Inventor

Signature of Inventor

Aug. 21, 1995
Date

8/21/95
Date

Date

Attorney Docket: WRIPLASTIC
Express Mail: TB138968049US

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of:

Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: (US original) 08/028,844 (new) _____
(PCT) PCT/US94/002433

Filed: (US original) March 10, 1993 (new) _____
(PCT) 08 March 1994

Group Art Unit: (US original) 1204 (new) _____

Examiner: (US original) D.C. Jones (new) _____

CERTIFICATE OF EXPRESS MAILING

I, Barbara A. Graves, hereby certify to the truth of the following items:

1. I am an employee of Santangelo Law Offices, P.C., 315 West Oak Street, Suite 701, Fort Collins, Colorado 80521.

2. I have this day deposited the attached Verified Statement of Small Entity Status of Frank D. Guffey and Floyd Alan Barbour with the United States Postal Service as "Express Mail" for mailing to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DATED September 6, 1995.

Barbara A. Graves

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
STATUS (37 CFR 1.9 (f) and 1.27 (d)) — NONPROFIT ORGANIZATION

I hereby declare that I am an official empowered to act on behalf of the nonprofit organization identified below:

NAME OF ORGANIZATION The University of Wyoming Research Corporation
d/b/a Western Research Institute
ADDRESS OF ORGANIZATION 365 North 9th Street, P.O. Box 3395, JMD 8/21/95
University Station, Laramie, Wyoming 82071-3395

TYPE OF ORGANIZATION

- ☒ University or other institution of higher education
☐ Tax exempt under Internal Revenue Service Code (26 USC 501(a) and 501(c) (3))
☐ Nonprofit scientific or educational under statute of state of The United States of America
(Name of state _____)
(Citation of statute _____)
☐ Would qualify as tax exempt under Internal Revenue Service Code (26 USC 501(a) and 501(c) (3)) if located in
The United States of America
☐ Would qualify as nonprofit scientific or educational under statute of state of The United States of America if located
in The United States of America
(Name of state _____)
(Citation of statute _____)

I hereby declare that the nonprofit organization identified above qualifies as a nonprofit organization as defined in 37 CFR 1.9 (e) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code with regard to the invention entitled Process for Waste Plastic Recycling by inventor(s) _____ described in _____

- ☒ the specification filed herewith
☐ application serial no. _____, filed _____
☐ patent no. _____, issued _____

I hereby declare that rights under contract or law have been conveyed to and remain with the nonprofit organization with regard to the above identified invention.

If the rights held by the nonprofit organization are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9 (d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9 (d) or a nonprofit organization under 37 CFR 1.9 (e).

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME _____
ADDRESS _____
☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

NAME _____
ADDRESS _____
☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28 (b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Samuel M. Dorrence
TITLE IN ORGANIZATION Vice President and Assistant Secretary JMD 8/21/95
ADDRESS OF PERSON SIGNING 365 North 9th Street, P.O. Box 3395, JMD 8/21/95
University Station, Laramie, Wyoming 82071-3395

SIGNATURE Samuel M. Dorrence DATE 8/21/95

Attorney Docket: WRIPLASTIC
Express Mail: TB138968049US

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of:

Frank D. Guffey and Floyd Alan Barbour

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Group Art Unit: (US original) 1204 (new) _____

Examiner: (US original) D.C. Jones (new) _____

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2. I have this day deposited the attached Verified Statement Establishing Small Entity Status of the University of Wyoming Research Corporation with the United States Postal Service as "Express Mail" for mailing to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DATED: September 6, 1995

Barbara A. Graves

FORM PTO-1595

RECORDATION FORM COVER SHEET PATENTS ONLY

U.S. DEPT. OF COMMERCE

(Rev. 6-93)

Patent and Trademark Office

To the Honorable Commissioner of Patents and Trademarks: Please record the attached original documents or copy thereof.

1. Name of conveying party(ies):

Frank D. Guffey and Floyd Alan Barbour

Additional name(s) of conveying party(ies) attached? ☐ Yes ☒ No

2. Name and address of receiving party(ies)

The University of Wyoming Research Corporation
d/b/a Western Research Institute

Internal Address:

Street Address: 365 North 9th Street

City: Laramie State: WY Zip: 82071-3395

Additional name(s) & address attached? ☐ Yes ☒ No

3. Nature of conveyance:

☒ Assignment☐ Merger☐ Security Agreement☐ Change of Name☐ Other _____

Execution Date(s): August 21, 1995

4. Application number(s) or patent number(s):

If this document is being filed together with a new application, the execution date of the declaration is: August 21, 1995.

A. Patent Application No.(s):

B. Patent No.(s):

Additional numbers attached? ☐ Yes ☒ No

5. Name and address of party to whom correspondence concerning document should be mailed:

Name: Luke Santangelo

Internal Address: Santangelo Law Offices, P.C.

Street Address: 315 W. Oak Street, #701

City: Fort Collins State: Colorado Zip: 80521

6. Total number of applications and patents involved: 1

7. Total fee (37 CFR 3.41)\$ 40.00

☒ Enclosed (in prior filing)☐ Authorized to be charged to deposit account

8. Deposit account number:

(Attach duplicate copy of this page if paying by deposit account)

DO NOT USE THIS SPACE

9. Statement and signature.

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Luke Santangelo

Name of Person Signing

Signature

Date

Total number of pages including cover sheet, attachments, and document: 1

Mail documents to be recorded with required cover sheet information to:
 Commissioner of Patents & Trademark, Box Assignments
 Washington, DC 20231



IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Application of: Frank D. Guffey and Floyd Alan Barbour

For: Process for Plastic Recycling

Serial Number: _____

Filed: _____

Assignee: ^{md 9/21/95}
The University of Wyoming Research Corporation d/b/a Western Research Institute

ASSIGNMENT OF PATENT RIGHTS

THIS ASSIGNMENT is made the 21st day of August, 1995, between and among Frank D. Guffey, whose address is 5905 Chapparral Drive, Laramie, Wyoming 82070, U.S.A., and Floyd Alan Barbour, whose address is 4429 Comanche Drive, Laramie, Wyoming 82070, U.S.A. (the "Inventors"), and The University of Wyoming Research Corporation, d/b/a Western Research Institute, having its principal office at 365 North 9th Street, Laramie, Wyoming 82071-3395, U.S.A. (the "Assignee").

WHEREAS the Inventors applied for the issuance of United States Letters Patent for an invention entitled "Process for Waste Plastic Recycling" on March 10, 1993 which received the serial number 08/028,844 and has since been abandoned ("Invention I");

WHEREAS the Inventors filed a Patent Cooperation Treaty (PCT) application based in part upon Invention I entitled "Process for Waste Plastic Recycling" on March 8, 1994 which received the international application number PCT/US94/02433 and whereas the Inventors are applying for the issuance of United States Letters Patent for an invention entitled "Process for Waste Plastic Recycling" based upon this PCT application ("Invention II");

WHEREAS the Inventors and Assignee desire to formalize the assignment of the Inventors' entire right, title and interest in and to Inventions I and II including but not limited to all rights to make, use, and sell the subject of Inventions I and II for their entire patent terms;

NOW, THEREFORE, the parties hereby agree as follows:

The Inventors, for good and valuable consideration, hereby grant and assign to the Assignee the entire right, title, and interest in Inventions I and II, including but not limited to all rights to make, use, and sell Inventions I and II, and to file for foreign patents based upon the application for Invention I, the PCT application, or the U.S. application for Invention II or any continuations or divisionals thereof.

This assignment shall be binding on all parties, their heirs, successors, and assigns, and may be recorded in the United States Patent and Trademark Office.

INVENTORS:

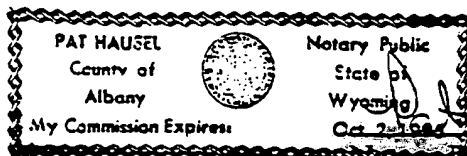
Frank D. Guffey
Frank D. Guffey

Floyd Alan Barbour
Floyd Alan Barbour

UNITED STATES OF AMERICA)
)
STATE OF WYOMING) ss.
)
COUNTY OF Albany)

SUBSCRIBED AND SWORN to before me in the County of Albany, State of Wyoming, United States of America, by Frank D. Guffey, this 21st day of August, 1995.

WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Wyoming.

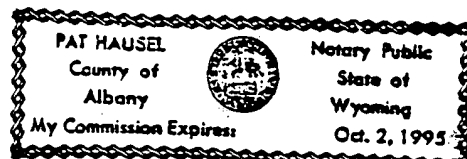


My Commission Expires: October 2, 1995

UNITED STATES OF AMERICA)
)
STATE OF WYOMING) ss.
)
COUNTY OF Albany)

SUBSCRIBED AND SWORN to before me in the County of Albany, State of Wyoming, United States of America, by Floyd Alan Barbour, this 21st day of August, 1995.

WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Wyoming.



Pat Hausel
Notary Public
My Commission Expires: October 2, 1995

Express Mail No: EM 000783532US
Attorney Docket: WRIPLASTIC-Div

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of:

Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: 08/525,639 New Serial No.: _____

Filed: September 6, 1995 New Filing Date: _____

Group Art Unit: 1106 New Group Art Unit: _____

Examiner: Nina Bhat New Examiner: _____

CERTIFICATE OF EXPRESS MAILING

I, Barbara Graves, hereby certify to the truth of the following items:

1. I am an employee of Santangelo Law Offices, P.C., 125 South Howes, Third Floor, Fort Collins, Colorado 80521.

2. I have this day deposited the attached new formal drawing with the United States Postal Service as "Express Mail" for mailing to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DATED: May 15, 1998

Barbara Graves
Barbara Graves

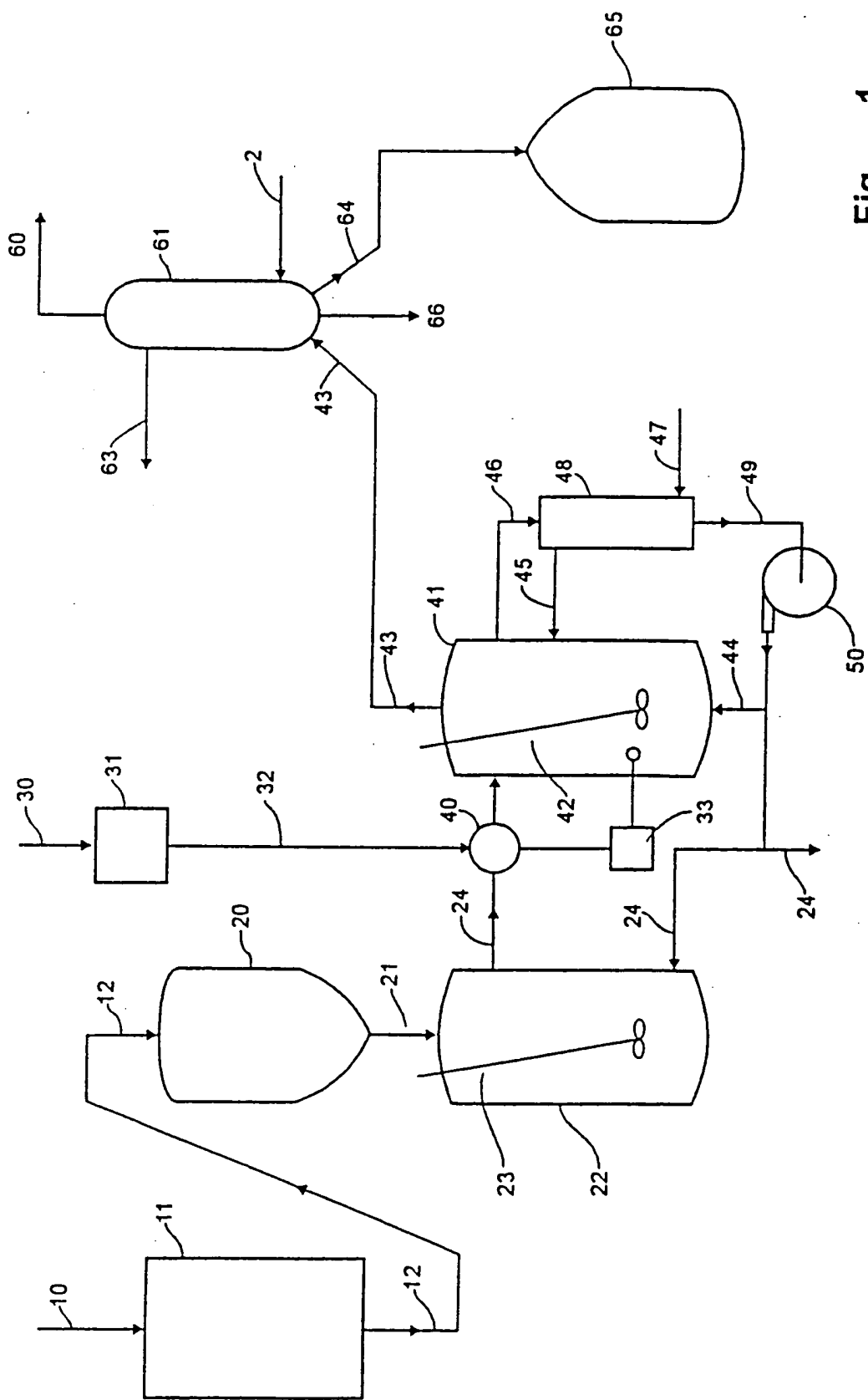


Fig 1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE INFORMATION DISCLOSURE CITATION	DOCKET NO. WRI-PLASTIC	SERIAL NO. (PARENT NO. 08/525,639)
	APPLICANT (S) Frank D. Guffey and Floyd Alan Barbour	
	FILING DATE: September 6, 1995	ART UNIT: 1106

I. U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS	FILING DATE
	5,608,136	3/1997	Maezawa et al.	588	228	
	5,597,451	1/28/97	Nagai et al.	201	4	
	5,584,969	12/17/96	Nagi et al.	196	116	
	5,368,723	11/1994	Takahashi et al.	208	427	
	5,226,926	7/13/93	Matsuzaki	44	530	6/15/92
	4,657,400	4/1987	Suehisa et al.	366	144	
	4,584,421	4/22/76	Saito et al.	201	2.5	
	4,417,529	11/1983	Fujimoto et al.	110	346	
	3,945,810	3/23/76	Saito	48	76	
	3,700,615	10/24/72	Scott	260	2.3	12/11/70

II. FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NO	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO
	DT 25 30 229	6/27/77	Germany				X
	WO 88/08020	10/20/88	WIPO	C10G1	10	X	
	EPO 0 132 612 A1	2/13/85	Europe	C10G1	10		X

III. OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	"Tar Sand Pyrolysis with Product Oil Recycling-Progress Report", C.Y. Cha, F.D. Guffey, and L.J. Romanowski, Jr. September 1987, Laramie, Wyo., DOE Report DOE/MC/11076-2642.
	"Eastern Oil Shale Conversion Using the ROPE Process, C.Y. Cha, L.J. Fahy, F.D. Guffey, September 1988, Laramie, Wyo.; Work performed under DE-FC21-86MC11076
	"Laboratory Simulation Studies of the Recycle Oil Pyrolysis and Extraction Concept, F. D. Guffey and D. E. Hunter, August 1989. Laramie, WY, DOE Report DOE/MC11076-3032.
	"Studies on Thermal Decomposition of Plastic Wastes II--Pyrolysis of Plastic Wastes by The Solvent Method", Journal of the Fuel Society of Japan, 53, 715-725, O. Inomata, H. Ando, T. Abe, 1974 (Provided in Japanese language with English data and an English synopsis).
	"Solid Waste Concerns Spur Plastic Recycling Efforts", Chemical and Engineering News, January 30, 1989, 7-15, A.M. Thayer

	"Preliminary Results of Tar Sand Pyrolysis with Product Oil Recycling," by Cha, et al., September 1986 for U.S. Department of Energy, pp. 1- 27
	"Procedyne Waste Pyrolysis Process," by Gary Balsam, presented at the Joint Seminar sponsored by Procedyne Corp., U.S. Dept. of Energy and U.S. Chemicals on July 15, 1982 at Pasadena, Texas, pp. 52-60
	"Pyrolysis of Rubber Wastes in Heavy Oils and use of the Products," by Bouvier, et al., published in Resources and Conservation in 1986, pp. 77-93
	"Thermogravimetric and Free Radical Evidence for Improved Liquefaction of Coal with Waste Tires," Ibrahim et al., American Chemical Society, Division of Fuel Chemistry, Volume 38, No. 3, August 1993, pp. 840-847
	"The Depolymerization of Polymethylene and Polyethylene," by Wall, et al., pp. 3430-3437, July 5, 1954
	"Coal and Oil/Resid Coprocessing Symposium," "Coprocessing of Hydrocarbonaceous Waste and Residual Oil - A Novel Approach to Recycling," Anderson, et al., American Chemical Society Preprints, Division of Petroleum Chemistry, Inc., pp. 335-338, April 1993
	"Thermal Recycling of Polymers," Journal of Analytical and Applied Pyrolysis, by W. Kaminsky, pp. 439-448, 1985
	"Catalytic Decomposition of Polyethylene Using A Tubular Flow Reactor System," Vol. 69 FUEL August 1990, pp. 978-984, by Ishihara et al.
	"Value Recovery from Polymer Wastes by Pyrolysis," Vol. 18 Polymer Engineering and Science July 1978, pp. 721-727, by Roy et al.
	"Fast Pyrolysis of Plastic Wastes," Vol. 4, No. 4 Energy and Fuels 1990, by Scott et al., pp. 407-411
	"Plastics Recycling," R.J. Ehrig, Editor, pp. 1-16, 178-183
	"Summary of Laboratory Simulation Studies of the ROPE TM Process," pp. 1-79, December 1991, by Guffey et al., Reported to the U.S. Dept. of Energy, Office of Fossil Energy
	"Laboratory Simulation Studies of Steady-State and Potential Catalytic Effects in the ROPE TM Process," Reported to the U.S. Dept. of Energy, Office of Fossil Energy.
EXAMINER	DATE CONSIDERED
EXAMINER: Please initial if citation considered, whether or not citation is in conformance with MPEP § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.	

Express Mail No: EM 000783532US
Attorney Docket: WRIPLASTIC-Div

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of:

Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: 08/525,639 New Serial No.: _____

Filed: September 6, 1995 New Filing Date: _____

Group Art Unit: 1106 New Group Art Unit: _____


Examiner: Nina Bhat New Examiner: _____

CERTIFICATE OF EXPRESS MAILING

I, Barbara Graves, hereby certify to the truth of the following items:

1. I am an employee of Santangelo Law Offices, P.C., 125 South Howes, Third Floor, Fort Collins, Colorado 80521.
2. I have this day deposited the attached Information Disclosure Citation with copies of the cited references with the United States Postal Service as "Express Mail" for mailing to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DATED: May 15, 1998



Barbara Graves

Express Mail No: EM 000783532US
Attorney Docket: WRIPLASTIC-Div

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Frank D. Guffey and Floyd Alan Barbour

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Examiner: Nina Bhat New Examiner: _____

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.97 and 1.98

As a means of complying with the duty of disclosure set forth in 37 C.F.R. §1.56, §1.97, and §1.98, the following information may be material to the examination of the referenced application. Pursuant to 37 C.F.R. Section 1.97(g), this Information Disclosure Statement should not be construed as a representation that a search has been made. A copy of each item is enclosed with a listing similar to PTO Form 1449 for the examiner's convenience.

Document Number: EP 0 132 612 A1
Date of Publication: February 13, 1985
Applicant: Coenen, et al.
Country of Origin: Europe
Explanation of Relevance: This document was cited in the international phase of this application by the European Patent Office acting as the International Searching Authority. The international search report describes it as defining the general state of the art which is not considered to be of particular relevance.

Document Number: DT 25 30 229
Date of Publication: June 27, 1977

Applicant: Wurfel
Country of Origin: W. Germany
Explanation of Relevance: This document was cited in the international phase of this application by the European Patent Office acting as the International Searching Authority. The international search report describes it as defining the general state of the art which is not considered to be of particular relevance.

Title: Studies on Thermal Decomposition of Plastic Wastes II--Pyrolysis of Plastic Wastes by The Solvent Method", Journal of the Fuel Society of Japan, 53, 715-725
Date of Publication: 1974
Author: O. Inomata, H. Ando, T. Abe
Country of Origin: Japan
Explanation: This publication has English data and an English synopsis that states it relates to the pyrolysis of plastic wastes.

Dated this 15 day of May, 1998.

Respectfully Submitted,
SANTANGELO LAW OFFICES, P.C.

By: 

Brit Nelson
Attorney for Applicant
PTO No.40,370
125 South Howes, Third Floor
Fort Collins, Colorado 80521
(970) 224-3100

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Express Mail No: EM 000783532US
Attorney Docket: WRIPLASTIC-Div

IN THE UNITED STATES PATENT AND
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DATED: May 15, 1998



Barbara Graves

TO: The Commissioner of Patents & Trademarks

Box Issue Fee

Washington, DC 20231

Docket No: WRI-PlasticDIV

Serial No: 08/525,639

Please confirm receipt of the following documents by
applying your date stamp below:

a Preliminary Amendment; copies of original
specification, claims, drawing, assignment, declaration, power
of attorney, small entity statement (individual), small entity
statement (non profit organization) for parent application
S/N: 08/525,639; a new formal drawing; an information
disclosure citation; an information disclosure statement; a
cashier's check in the amount of \$395.00; a fee calculation
sheet; a Certificate of Mailing, and a Letter of Transmittal.

Date:



EXPRESS MAIL
UNITED STATES POSTAL SERVICE



UNITED STATES POSTAL SERVICE



INTERNATIONAL SHIPMENTS ONLY <input type="checkbox"/> Business Papers <input type="checkbox"/> Merchandise <input type="checkbox"/> Storage forms and commercial code may be required. <input type="checkbox"/> Pub. 275 and 1984 International Mail Manual	P.O. ZIP 8105121	Day of Delivery <input checked="" type="checkbox"/> Next <input type="checkbox"/> Second <input type="checkbox"/> Flat Rate Envelope	
	Date In Mo. 5 Day 15 Yr 98	<input checked="" type="checkbox"/> 12 Noon <input type="checkbox"/> 3 PM	Postage \$ 26.45
	Time In 1655 <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	Military <input type="checkbox"/> 2nd Day <input type="checkbox"/> 3rd Day	Return Receipt <input type="checkbox"/>
	Weight 6 lbs 13 oz	Int'l Alpha Country Code 10	C.O.D. On Delivery Payment
No Delivery <input type="checkbox"/> Weekend <input type="checkbox"/> Holiday	Acceptance Clerk Initials 10	Total Postage & Fees \$ 26.45	

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☐ **WAIVER OF SIGNATURE (Domestic Only):** I wish delivery to be made without obtaining the signature of the addressee or the addressee's agent (#) in the judgment of the delivery employee, the article can be left in a secure location and I authorize the delivery employee to leave the shipment(s) delivered and understand that the signature of the delivery employee will constitute valid proof of delivery.

☐ **NO DELIVERY**

☐ **WEEKEND** ☐ **HOLIDAY**

*DELIVER TO ADDRESSEE'S BUSINESS ADDRESS ONLY IF YOU HAVE BEEN ADVISED BY THE CARRIER TO DO SO.

FROM: (PLEASE PRINT) _____ PHONE: _____
SANTANGELO LAW OFFICES
~~315 W OAK ST FL 7~~
FORT COLLINS CO 80521-2703

Ref: WRI-Plastic-DIV

TO: (PLEASE PRINT) _____ PHONE _____
THE COMMISSIONER OF PATENTS
AND TRADEMARKS
WASHINGTON, D.C. 20231

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of: Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: 08/525,639 New Serial No.: _____

Filed: September 6, 1995 New Filing Date: _____

Group Art Unit: 1106 New Group Art Unit: _____

Examiner: Nina Bhat New Examiner: _____

AFFIDAVIT OF BARBARA GRAVES

UNITED STATES OF AMERICA)
STATE OF COLORADO) ss.
COUNTY OF LARIMER)

I, Barbara Graves, duly sworn and under oath, declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true.

1. I am an employee of the law firm of Santangelo Law Offices, P.C. in Fort Collins, Colorado. I have been associated with this law firm for five years. My current job title is intellectual property paralegal.

2. As part of my duties as an employee, I have spent at least five years assisting attorneys at Santangelo Law Offices, P.C. in the prosecution of patent applications before the U.S. Patent and Trademark Office (PTO).

3. I assisted in the preparation of the divisional patent application in the above referenced matter.

4. The documents attached to the petition in this matter were deposited in Express Mail on May 15, 1998.

5. I follow a customary practice, as evidenced by the attached "Required Procedure for ALL Certificate of Express Mail or First-Class Mailing", when assisting in filing a patent application. This customary practice in assisting in the filing of a patent application is to:

- obtain all of the documents for the patent application;

- obtain the Express Mail envelope;
- obtain the Express Mail label from the patent attorney I am assisting;
- sign and date the Express Mail certificates;
- immediately copy all documents for files (within 2 minutes);
- firmly and securely attach Express Mail certificates to their specific documents; i.e., stapled or otherwise,
- use the transmittal letter to cross check separate items,
- make sure all signature documents have been signed,
- count the number of pages and check the attachment of the certificates;
- immediately after cross checking, sign and copy all documents,
- secure all documents together as appropriate;
- staple the check to the top of the Letter of Transmittal;
- paper clip the postcard receipt to the top of the packet,
- assure that each document is indeed placed in the Express Mail envelope;
- seal the Express Mail envelope (I never open the Express Mail package once I have sealed it); and finally;
- personally deposit or direct staff of Santangelo Law Offices to personally deposit the Express Mail package by hand carrying the Express Mail package to the United States Post Office and handing the Express Mail package to an employee of the United States Postal Service.

6. I affirm that I followed this customary practice in filing the original application in the above referenced matter. Because I followed my customary procedure in filing the divisional application in the above referenced matter, I know that the documents that were deposited with the United States Post Office on May 15, 1998 contained:

- 1) a Letter of Transmittal, a fee calculation sheet, a cashier's check in the amount of \$395.00 and a change of correspondence address;
- 2) a Preliminary Amendment;
- 3) copies of parent application, serial number 08/525,639, including copies of the original specification, original claims and informal drawing, the original combined declaration and power of attorney executed by the inventors, a power of attorney executed by the assignee, Western Research Institute, the verified statement establishing small entity status (independent inventor), the verified statement establishing small entity status (non-profit organization), and the assignment of patent rights;
- 4) a new formal drawing (1 sheet);
- 5) an Information Disclosure Citation with copies of the cited references;
- 6) an Information Disclosure Statement under 37 C.F.R. §1.97 & 1.98;
- 7) Express Mail Certificates for each document; and
- 8) a return receipt postcard.

7. On September 30, 1998, I recall that I directed staff to contact the Patent Office with regard to the status of the divisional application filed on May 15, 1998, specifically to determine if an examiner had been assigned to the application. Upon review of our files it was confirmed that no filing receipt had been received by our office for the application. Upon further review of the file, it was determined that the return postcard receipt filed with the divisional application of May 15, 1998

had not been received by our office. The telephone inquiry to the Patent Office on September 30, 1998 resulted in discovering that the Express Mail package containing the divisional application deposited by our office on May 15, 1998 had not been made of record by the Patent Office. Upon learning that the PTO had not made of record the divisional application filed by our office on May 15, 1998, I recalled that I had assisted Mr. Nelson in filing the divisional application in the above referenced matter on that date. I specifically remember that I was the individual who had certified the mailing of the documents for the divisional application in the above referenced matter and who had deposited the documents in the Express Mail package before directing staff to hand deliver the Express Mail package to the United States Post Office.

8. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated this 5th day of January, 2001.


Barbara Graves


UNITED STATES OF AMERICA)
)
STATE OF COLORADO)ss.
)
COUNTY OF LARIMER)

SUBSCRIBED AND AFFIRMED OR SWORN to before me in the County of Larimer, State of Colorado, United States of America, by Barbara Graves this 5 day of January, 2001.

WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.



My Commission Expires 07/15/2003


Notary Public
My Commission Expires: 7-15-2003

SANTANGELO Law Offices, P.C.

*125 S. Howes, 3rd Floor
Fort Collins, CO 80521
(970) 224-3100 FAX (970) 224-3175*

FACSIMILE TRANSMISSION

THIS MESSAGE IS INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY TO WHICH IT IS ADDRESSED. AND MAY CONTAIN INFORMATION THAT IS PRIVILEGED, CONFIDENTIAL AND EXEMPT FROM DISCLOSURE UNDER APPLICABLE LAW. IF THE READER OF THIS MESSAGE IS NOT THE INTENDED RECIPIENT, OR THE EMPLOYEE OR AGENT RESPONSIBLE FOR DELIVERING THE MESSAGE TO THE INTENDED RECIPIENT, YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION OR COPYING OF THIS COMMUNICATION IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THIS COMMUNICATION IN ERROR, PLEASE NOTIFY US IMMEDIATELY BY TELEPHONE, AND RETURN THE ORIGINAL MESSAGE TO US AT THE ABOVE ADDRESS VIA THE U.S. POSTAL SERVICE. THANK YOU.

TO: **TARRA**
FAX: 307-672-1423
TELEPHONE: 307-672-1402

FROM: Patti Sortino

TRANSMISSION PROBLEMS, CALL: Patti Sortino

TOTAL PAGES: 2 (INCLUDING THIS COVER PAGE)

DATE: November 17, 1998

☒ x Facsimile Only
☐ Facsimile to be followed by hard copy

Client Reference:

MESSAGE:

We are faxing you a front copy of the issued check.
Please fax back a copy of the back of the check for proof of
payment.

Jersey
1201 572 1423

THIS DOCUMENT HAS AN ARTIFICIAL WATERMARK PRINTED ON THE BACK. THE FRONT OF THE DOCUMENT HAS A MICRO-PRINT SIGNATURE LINE. ABSENCE OF THESE FEATURES WILL INDICATE A COPY.



First Interstate Bank
(307) 672-1402
4 South Main Street
Sheridan, Wyoming 82801

500 5520404

75-1522/910

University of Wyoming Research Corporation

DATE May 13, 92

REMITTER

PAY

EXACTLY **395** DOL 00 CTS

TO THE

\$ 395.00

ORDER OF

Commissioner of Patents & Trademarks

OFFICIAL CHECK

DRAWER: FIRST INTERSTATE BANK

DRAWER: TRAVELERS EXPRESS COMPANY, INC.
P.O. BOX 9476 MINNEAPOLIS, MN 55480
DRAWEE: FIRSTAR BANK OF MINNESOTA, N.A. ST. PAUL, MN

1:091015224:00500 5520404211

NOV-17-98 TUE 09:22 AM

FAX NO.

6721443

P. 01

FAX

FIRST INTERSTATE BANK

Date

11-17-98

Number of pages including cover sheet

2

To:

Patricia Soriano

From:

Tara Dolechek

Operations

Statements/Research

Phone

970-224-3100

Fax Phone

970-224-3125

CC:

Phone

307-672-1488

Fax Phone

307-672-1423

REMARKS:

☐ Urgent

☒ For your review

☐ Reply ASAP

☐ Please comment

If you cannot read let us know
and we can send you a copy.

Tara

RECEIVED
DATE

OLIVIERO TOSCANI

6666 71473

1800001294
FIRST PRIZE
LAFAYETTE
1800001294

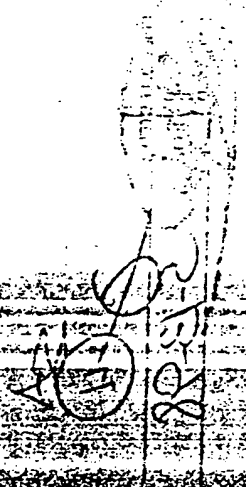
MAY 13 98

MS-RC
05/13/98 10:39A
0009 L7 0004 H 102

200 2250404

\$395.00

* 1200 *



1800001294

SANTANGELO Law Offices, P.C.

**125 S. Howes, 3rd Floor
Fort Collins, CO 80521
(970) 224-3100 FAX (970) 224-3175**

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TO: PATENT AND TRADEMARK OFFICE

Attn: Kathy Sheffey

FAX: 703-308-2840

TELEPHONE: 703-308-1202

(0341)

FROM: Patti Sortino

TRANSMISSION PROBLEMS, CALL: Patti Sortino

TOTAL PAGES: 4 (INCLUDING THIS COVER PAGE)

DATE:

☒ Facsimile Only
☐ Facsimile to be followed by hard copy

**Client Reference: WRI - PLASTIC - DIV - Filed May 15, 1998
Inv. Frank D. Guffey**

MESSAGE:

We mailed via Express Mail #EM000783532US, a Preliminary Amendment, to be entered with this filing prior to calculation of the filing fee; copies of parent application serial number 08/525,639, including copies of the original specification, original claims and informal drawing, the original combined declaration and power of attorney, the verified statement establishing small entity status (independent inventor), the verified statement establishing small entity status (non-profit organization), and the assignment of patent rights; a new formal drawing (1) sheet; information Disclosure Citation with copies of the cited references; Information Disclosure Statement under 37 CFR 1.97 & 1.98; a Letter of Transmittal, a fee calculation sheet and a cashier's check in the amount of \$395.00; and Express Mail Certificates for each document.

I am now faxing a front and back copy of the cashier's check that was sent. I have called several times, but was told that none of the documents could be found with the information from the canceled check.

Please notify me as soon as possible so that we can get the correct dates into our tracking system.

Thank you,

Patti Sortino

Jeran
1421 672 1423

THIS DOCUMENT HAS AN ARTIFICIAL WATERMARK PRINTED ON THE BACK. THE FRONT OF THE DOCUMENT HAS A MICRO-PRINT SIGNATURE LINE. ABSENCE OF THESE FEATURES WILL INDICATE A COPY.



First Interstate Bank
(307) 672-1402
4 South Main Street
Sheridan, Wyoming 82801

500 5520404

75-1522/910

University of Wyoming Research Corporation

DATE May 13, 98

REMITTER

PAY

EXACTLY **\$395** DOL 00 CTS

TO THE

\$ 395.00

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Commissioner of Patents & Trademarks

OFFICIAL CHECK

DRAWER: TRAVELERS EXPRESS COMPANY, INC.
P.O. BOX 9476 MINNEAPOLIS, MN 55480
DRAWEE: FIRST STAR BANK OF MINNESOTA, N.A. ST. PAUL, MN

DRAWER: FIRST INTERSTATE BANK



⑆091015224⑆00500

55204042⑈

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of: Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: 08/525,639 New Serial No.: _____

Filed: September 6, 1995 New Filing Date: _____

Group Art Unit: 1106 New Group Art Unit: _____

Examiner: Nina Bhat New Examiner: _____

AFFIDAVIT OF LUKE SANTANGELO

UNITED STATES OF AMERICA)

STATE OF COLORADO) ss.

COUNTY OF LARIMER)

I, Luke Santangelo, duly sworn and under oath, declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true.

1. I am an attorney of the law firm of Santangelo Law Offices, P.C. in Fort Collins, Colorado. I have been associated with this law firm for ten years.

2. As part of my duties as an attorney, I have spent at least sixteen years involved in the prosecution of patent applications before the United States Patent and Trademark Office (PTO). My registration number before the PTO is 31,997.

3. I prepared the internal office procedures for all mailings to the United States Patent and Trademark Office. These procedures are attached as Exhibit 9 to the Petition to Accord Applicant Filing Date of Express Mail Certificate filed with this affidavit. The procedures are mandatory for all staff and each staff person is instructed on the importance of following them without deviation.

4. Attached to the petition associated with this affidavit are true and correct copies of various documents submitted by our office in this matter. Our standard office procedures were followed in filing this case. Also attached as "Exhibit 10" is a true and correct copy of the "Express Mail" receipt showing the actual date and time of mailing as filled in by USPS officials.

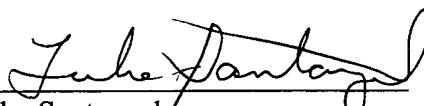
5. When I learned that the postcard receipt had not been received in this matter, I directed that steps be taken to ascertain the status of the application within the PTO. I know that these steps included at least the following:

- a. As evidenced by Exhibit 3, on September 30, 1998, Barbara Graves, an employee of the undersigned firm directed further efforts to determine the status of the application.
- b. As evidenced by Exhibit 4, on November 17, 1998, Patti Sortino, an employee of the undersigned firm determined that the cashier's check payable to the PTO had indeed, cleared.
- c. Shortly after that date, and after several telephone calls to the PTO, a fax was sent to Ms. Kathy Sheffey of the PTO to provide evidence that that check has, indeed, cleared and to request action. This fax is attached as Exhibit 5.
- d. Since no response was received, I personally made another telephone call to Ms. Kathy Sheffey of the Patent Office on May 12, 1999, to inquire as to status.
- e. In response to the renewed inquiry, on May 14, 1999 I personally spoke with Mr. Preston Wallace of the Patent Office. Mr. Wallace indicated that the application filed on May 15, 1998 may have been mistaken as an amendment by the PTO and that he desired copies of some documents and would begin tracing it within the PTO.
- f. On May 14, 1999, at the request of Mr. Preston Wallace, I directed that copies of certain documents be provided to Mr. Wallace via facsimile.
- g. On May 17, 1999, I personally spoke with Mr. Wallace who advised me that he had received the facsimile transmission and that he would trace the check and call back.
- h. On July 12, 1999, I personally spoke with Examiner Neena Bhat, the examiner in the parent case. From this conversation, it appeared that the PTO had lost almost all of the documents associated with the filing. Ms. Bhat indicated that she would discuss the case with Mr. Preston Wallace and advise if the applicant needed to do anything to proceed.
- i. Since we had not heard from the PTO, on or about November 14, 2000, I directed staff to follow up on the telephone calls made. Staff made calls on November 14, 2000 to Mr. Wallace who indicated that the file had not yet been located but that he would continue to look for it; on November 15, 2000, to Examiner Bhat who indicated that she was not familiar with the case, but that she would look into it further and call back; and on November 17, 2000 to Mr. Doug McGinty who indicated that the applicant may need to file a petition along with copies of the originally filed application and suggested the firm contact the petitions office.
- j. On December 28, 2000, I personally spoke with Mr. John Gillon of the Office of Petitions. Mr. Gillon suggested that the present petition be filed to prompt action within the PTO.

6. I know that the indicated papers were filed with the PTO on May 15, 1998.

7. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

DATED this 5th day of January, 2001.

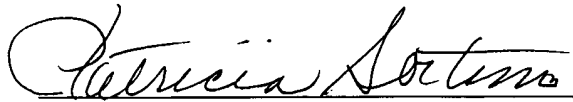


Luke Santangelo
ATTORNEY FOR APPLICANT
PTO No. 31,997
125 South Howes, Third Floor
Fort Collins, Colorado 80521
(970) 224-3100

UNITED STATES OF AMERICA)
STATE OF COLORADO)ss.
COUNTY OF LARIMER)

SUBSCRIBED AND SWORN OR AFFIRMED to before me in the County of Larimer, State of Colorado, United States of America, by Luke Santangelo, this 5th day of January, 2001.

WITNESS my hand and official seal pursuant to the authority vested in me as a Notary Public by the State of Colorado.



Notary Public
My Commission Expires: 3-2-2002

WRI- Plastic- Div.

11-14-00

SK

T/C Mr. Wallace

explained the situation & mentioned about Luke's call w/ Examiner Bott; he said he can't find it but will look further...

11-15-00

T/C Examiner ~~Bott~~ ^{what}

she received the wrong info. from Mr. Wallace, so I explained everything to her; she wasn't familiar w/ the case so she needed to look into it further & call me back; very nice

11-17-00

OPIE? - did check

talk w/ Examiner ^{Doug} McGinty, - very nice

703-308-3805

manager - special program

(FRI)

customer service 703-306-

examiner

5665

may need to
- file a petition;
w/ copies of
filed docs.

(FRI)

office of petitions
703-305-9285

doesn't show anything - no fax & no application

* work through office of petitions - 'cause 1002.02(b) item 23 - list this type of situations; call office of petitions & ask to be connected to someone in charge for this situation

12-28-00

WRI - Plastic Div

Chronology

5-15-98 filed

5-12-99 spls w/ Kathy Sheffey was to handle

5-14-99 " " Preston Wallace mistaken as another
not div's.

5-14-99 faxed to Preston

5-17-99 Preston has all & will let me know.

7-12-99 Ex Neena Bhat - will ask Preston &

~~11-14-99~~ let me know

11-14-00 Preston - can't find

11-15-00 Ex Bhat would look into it

11-17-00 Ex Dongy Mc Ginty may need petition - not
have with

Call Petitioner 703 305 9285

12-28 TCU Petitions - on hold forever - w/c via automated
system

John Gillon - atty. office of Petitioner CP-4-3C33
2201 S. Clark Place
Arlington, VA 22202
703 305 9285
reception

'95 shows - not the div's'l.

Cashier's clc

Said 1-12 to

must drop to USPS

show

plant procedures intend

Copy all incl'g clc -
prepare a petition to file
date
shall be a freebie.
offer to pay but/premium
rose since PTO error

Randy Green
him
in the
of From
power

Concl - Prep a Petition & copies
plant mail procedures

SANTANGELO LAW OFFICES, P.C.

Required Procedure for ALL Certificate of Express or First-Class Mailing

- 1) Sign and date Express or First-Class Mail certificates
- 2) Immediately copy all documents for files (within 2 minutes)
- 3) Firmly and securely attach Express Mail or First-Class certificates to their specific documents; i.e., stapled or otherwise
- 4) Using transmittal letter, cross check separate items, make sure all signature documents have been signed, count number of pages and attachment of certificates
- 5) Immediately after cross checking, signing and copying all documents, secure them all together; staple check to top of Letter of Transmittal (if appropriate) and paper clip postcard receipt to the top of packet. Make sure postcard has Date: _____ Serial No: _____ Express Mail # _____ should be on postcard (if appropriate)
- 6) Assure that each document is indeed placed in the Express Mail or First-Class envelope
- 7) Seal Express or First-Class Mail envelope - Note: opening of Express or First-Class Mail envelope once it is sealed is not permissible.
- 8) Double check postage
- 9) Deposit First-Class Mail envelope with the U.S. Postal Service that day via one of the following methods:
 - a) personally delivering to the postman
 - b) personally placing in an official U.S. Mailbox
 - c) personally placing in the firm's mail depository (top counter, next to bell) for daily pick up
 - d) directing staff to personally do one of the above

Part of the firm's procedure for outgoing first-class mail and certificate of first-class mail is to permit the postman daily access to the outgoing mail depository and/or have staff assemble and personally deposit all items.

ALL EXPRESS MAIL MUST BE HAND CARRIED TO POST OFFICE
(do not plan to place in U.S. Mailbox)

Dated 9-16-99

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of: Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: 08/525,639 New Serial No.: _____

Filed: September 6, 1995 New Filing Date: _____

Group Art Unit: 1106 New Group Art Unit: _____


Examiner: Nina Bhat New Examiner: _____

CERTIFICATE OF HAND DELIVERY

I, Luke R. Santangelo, hereby certify to the truth of the following items:

1. I am an employee of Santangelo Law Offices, P.C., 125 South Howes, Third Floor, Fort Collins, Colorado 80521.
2. I have this day hand delivered the attached Petition to Accord Application Filing Date; and this Certificate of Hand Delivery to the Commissioner of Patents and Trademarks, Office of Petitions, Suite CP-4, 2201 S. Clark Place, Room 3C23, Arlington, Virginia, 22202.

Dated January 8, 20001.



Luke R. Santangelo

RECEIVED

JAN 08 2001

Attorney Docket: *WRIPLASTIC*-Div

OFFICE OF PETITIONS

IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In Re the Patent Application of: Frank D. Guffey and Floyd Alan Barbour

For: Process for Waste Plastic Recycling

Serial Number: 08/525,639 New Serial No.: _____

Filed: September 6, 1995 New Filing Date: _____

Group Art Unit: 1106 New Group Art Unit: _____

Examiner: Nina Bhat New Examiner: _____

RECEIPT FOR HAND DELIVERY

The Undersigned, an employee of the United States Patent and Trademark Office, hereby acknowledges receipt of the following documents:

1. a Petition to Accord Application Filing Date of Express Mail;
2. a Certificate of Hand Delivery; and
3. this Receipt for Hand Delivery

DATED this ____ day of January, 2001

Signature: _____

Printed Name: _____